

WHAT IS CLAIMED IS:

1. An instrument pig for determining the characteristics of a ferromagnetic pipeline through which it passes, comprising:
 - a pig body coaxially supported and moving within the pipeline in response to fluid flow;
 - first and second coaxial circumferential, spaced apart magnets of opposed polarities supported to said pig body and providing substantially complete magnetic saturation of an area of the pipeline between the magnets;
 - first instruments supported by the pig body between said magnets and arranged to generate signals that are responsive to flux leakage servicing to provide first information as to anomalies in the pipeline interior and/or exterior surface;
 - second instruments employing pulsed and sensing coil pairs supported by the pig body between said magnets and arranged to generate signals that are responsive to eddy currents induced in the pipeline interior surface servicing to provide second information as to anomalies in the pipeline interior surface;
 - signal processing circuitry combining said first and second signals to indicate the magnitude and interior or exterior location of the pipeline anomalies; and
 - wherein said second instruments are energized only in response to signals generated by said signal processing circuitry.
2. An instrument pig according to Claim 1 wherein said first and second instruments are arranged in a plurality of closely spaced heads located circumferentially about said pig body and in a plane perpendicular the axis of the pipeline.

- 1 3. An instrument pig according to Claim 1 wherein said first instruments are Hall-effect
2 devices.
- 1 4. An instrument pig according to Claim 1 wherein said magnets are affixed at opposed
2 ends of elongated armatures that are in spaced apart parallel planes each including the
3 pipeline axis, the armatures being radially positionably supported to said pig body, said
4 first and second instruments being supported by the armatures.
- 1 5. An instrument pig according to Claim 4 wherein said armatures and magnets are arranged
2 such that mutual magnetic repulsion attains outward radial displacement towards the
3 pipeline inner cylindrical wall.
- 1 6. An instrument pig according to Claim 4 including spacers affixed to said armatures for
2 engaging the pipeline interior wall and thereby supporting said magnets and said first and
3 second instruments in close, predetermined spacing with respect to the pipeline interior
4 wall.
- 1 7. An instrument pig according to Claim 4 wherein said armatures are each supported to
2 said body by link arms.
- 1 8. An instrument pig according to Claim 1 wherein said first instruments are responsive to
2 detected reluctance variations as the pig is moved through the pipeline.
- 1 9. A pipeline pig according to Claim 1 wherein said second instruments are responsive to
2 detected induced current variations in the pipeline interior surface.

- 1 10. A method of determining the characteristics of the interior and exterior surfaces of a
2 metal pipeline comprising the steps of:
- 3 (a) moving an axially supported pig body through a pipeline;
 - 4 (b) by means of magnets carried by the pig body magnetically saturating a
5 circumferentially zone of the pipeline that moves with the pig;
 - 6 (c) continuously measuring changes of reluctance in the moving
7 circumferential zone to provide indications of the presence and size of anomalies in the
8 pipeline interior or exterior surfaces;
 - 9 (d) electrically energizing a plurality of pulse coils to induce eddy currents in
10 the internal surface of said moving circumferential zone of the pipeline;
 - 11 (e) by means of a plurality of sensing coils each paired with a said pulsed coil
12 measuring said eddy currents to determine the presence or absence of anomalies in the
13 pipeline interior surface;
 - 14 (f) comparing the results of steps (c) and (e) in signal processing circuitry to
15 determine whether the anomaly detected in step (c) is on the exterior or interior surface of
16 the pipeline;
 - 17 (g) recording the results of steps (c) and (f) to provide information as to the
18 occurrence, size and exterior/interior locations of pipeline wall anomalies; and
 - 19 (h) energizing said plurality of pulse coils in step (d) only in response to
20 signals generated by said signal processing circuitry.

- 1 11. A method according to Claim 10 in which step (c) and (e) are carried out by instruments
2 arranged in a plurality of closely spaced heads located circumferentially about said pig
3 body and in a plane perpendicular the axis of the pipeline.
- 1 12. A method according to Claim 10 in which step (c) is carried out using Hall-effect
2 devices.
- 1 13. A method according to Claim 10 wherein step (b) is carried out by magnets affixed at
2 opposed ends of elongated armatures that are spaced apart in parallel planes of the
3 pipeline axis and radially displaceably supported to the pig body.
- 1 14. A method according to Claim 13 including arranging said armatures so that the mutual
2 magnetic repulsion of the magnets supported thereon results in radially biasing said
3 armatures and instruments affixed thereon towards the pipeline inner, cylindrical surface.
- 1 15. A method according to Claim 14 including affixing spacers to said armatures for
2 engaging said pipeline inner cylindrical surface for thereby supporting said magnets and
3 said instruments in close, predetermined spacing with respect to said pipeline inner
4 cylindrical surface.
- 1 16. A method according to Claim 13 including affixing said armature to said pig body by
2 pivotal link arms.